TECHNICAL NOTES

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.

No. 117

THE SYNCHRONIZATION OF N.A.C.A. FLIGHT RECORDS.

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October, 1922.

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Summary.

A method is described for synchronizing the different instrument records taken during flight testing. This method has been in use for some time at the Langley Memorial Aeronautical Laboratory and has proved very valuable in connection with the study of controllability and other complicated problems of flight.

The peculiarities of flight testing have made necessary the development of a number of special recording instruments which can be placed in the airplane to record any desired characteristics of flight either directly or indirectly connected with the problem under investigation. The instruments developed for this purpose by the National Advisory Committee for Aeronautics all record by photographic means. They have already been described in a series of reports and technical notes.*

Although the film drums of these recording instruments are

* (1) Single component gyro (N.A.C.A. Report #155).
(2) Single component accelerometer (N.A.C.A. Reports #99 & 100).
(3) Three component accelerometer (N.A.C.A. Technical Note 112).
(4) Air speed meter (N.A.C.A. Technical Note #64).
(5) Control force recorder (N.A.C.A. Report #112).
(6) Control position recorder (N.A.C.A. Technical Note #97).
(7) Multiple manometer (N.A.C.A. Report #148).

driven by constant speed motors and are usually started and stopped by one central switch, it has been found necessary, especially in tests involving accelerated motion, to synchronize all records by an automatic timer. This has been done by placing in the instruments small incandescent lamps which are flashed at regular intervals by means of a common circuit through a chronometer. The flashes of these lamps passing as sheets of light through the film drum slits mark off vertical timing lines on the film records. Fig. 1 shows the position of a timing light in an instrument relative to the film drum and slit. The small light shield shown in the sketch is placed around the lamp to prevent reflection of light from the inside of the instrument case.

Fig. 2 shows the electrical connections which make it possible for the observer to start and stop the chronometer and recording instruments by closing a single switch.

A number of different electric chronometers have been made up and tested. The one illustrated in Fig. 3 has proved most satisfactory due to its rugged construction, enabling it to withstand plane vibration and rough handling. As can be seen from the illustration, it consists of the balance wheel (1), escapement (2), gears (3), and slipping main spring (4), of a chronometric tachometer coupled for driving to a small electric motor. A pair of brushes rubbing on a commutator (5) on the escapement spindle close the light circuit at 5-second intervals. A small balance wheel catch (6) stops the balance wheel when the motor circuit is opened, thus leaving an initial tension in the main spring to insure quick starting. This catch is operated by a small magnet un-

der the base of the instrument which is not visible in the illustration.

For convenience of installation the chronometer is provided with six plug sockets so that connections to the timing lights of six instruments can be made directly. An additional socket at the end of the timer connects with a key in the observer's cockpit. This key short circuits the commutator and enables the observer to mark on all records the time of any particular phase of the test.

A record of control positions showing the three-second timing intervals made by the synchronizer is reproduced in Fig. 4. In analyzing the results of a test all records are usually replotted against time, the corresponding values of which are determined on the records by the three-second interval lines. In this way it is possible to make up a single complete time picture of a test, all details of which are accurate to a small fraction of a second.

The device has been extensively used in the study of controllability and maneuverability where the sequence of events is too swift for direct personal observation. It has already made possible the taking of measurements for comparing the relative merits of combat airplanes.

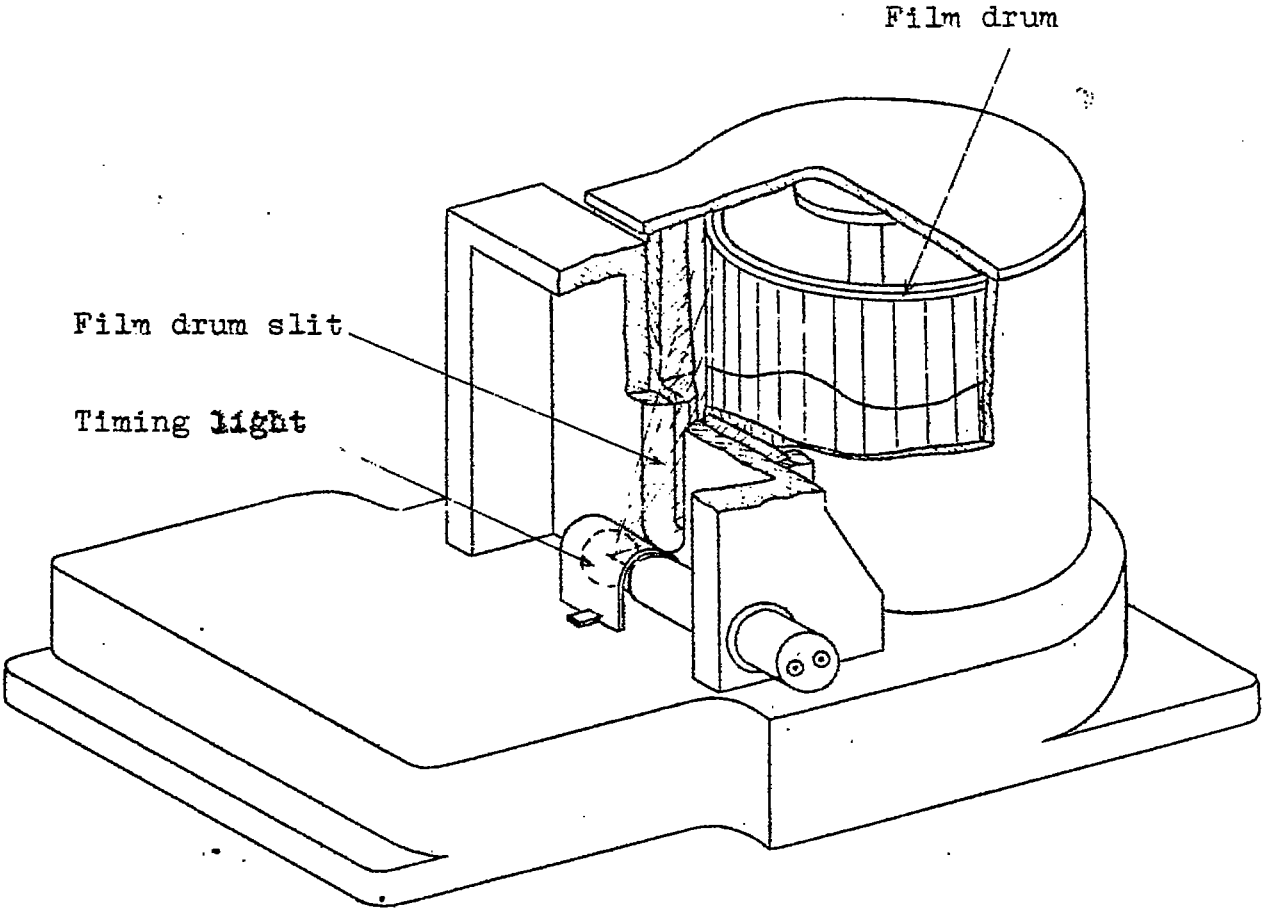

Fig. 1. POSITION OF TIMING LIGHT IN A RECORDING INSTRUMENT.

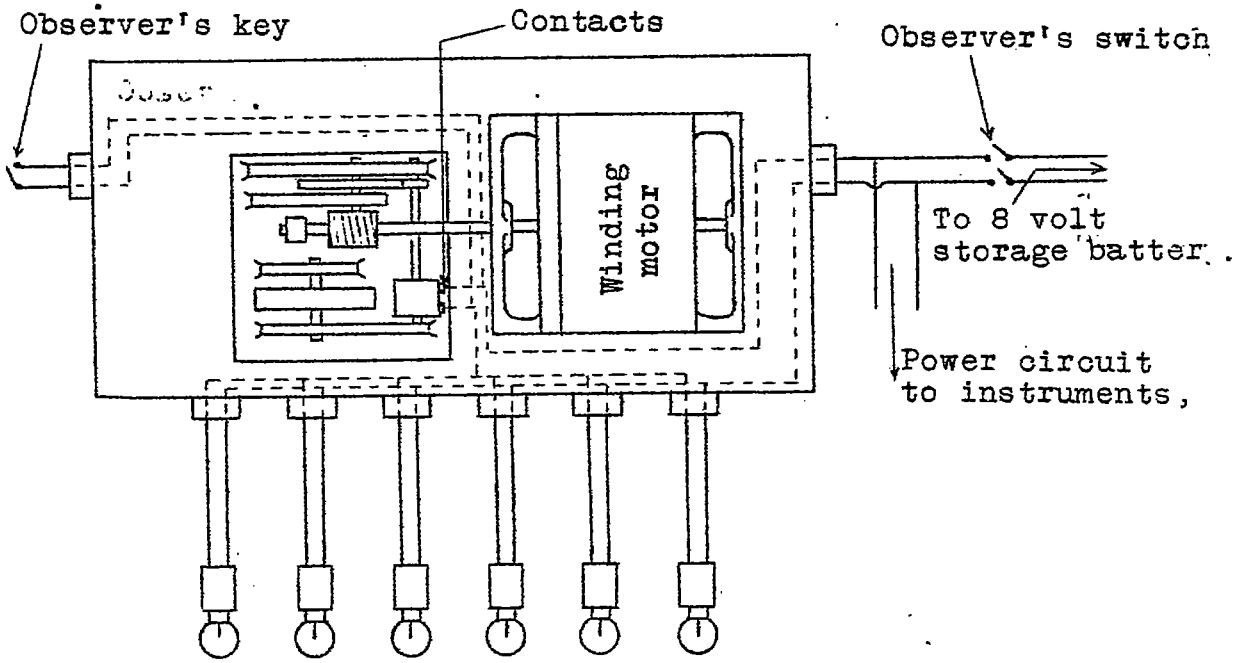

Fig. 2. WIRING OF CHRONOMETER AND INSTRUMENT TIMING LIGHTS.

Figs. 1-2

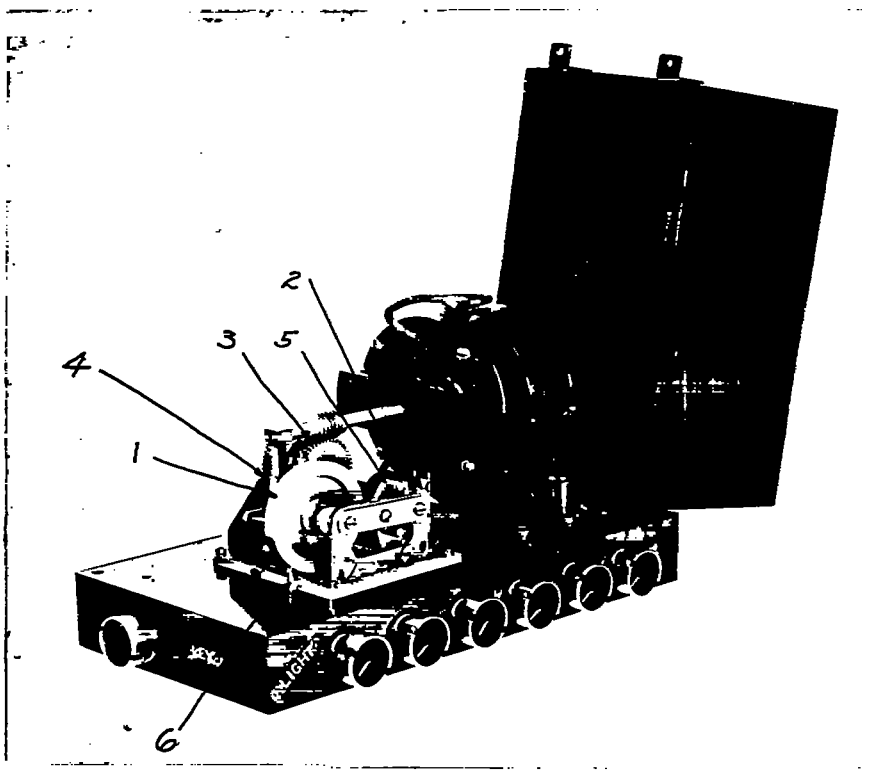

Fig.3. Electric Chronometer

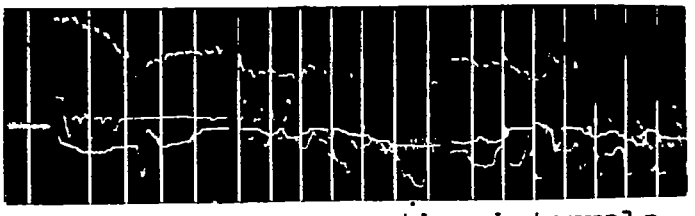

Fig.4. Three second time intervals on a record of the movement of airplane controls.